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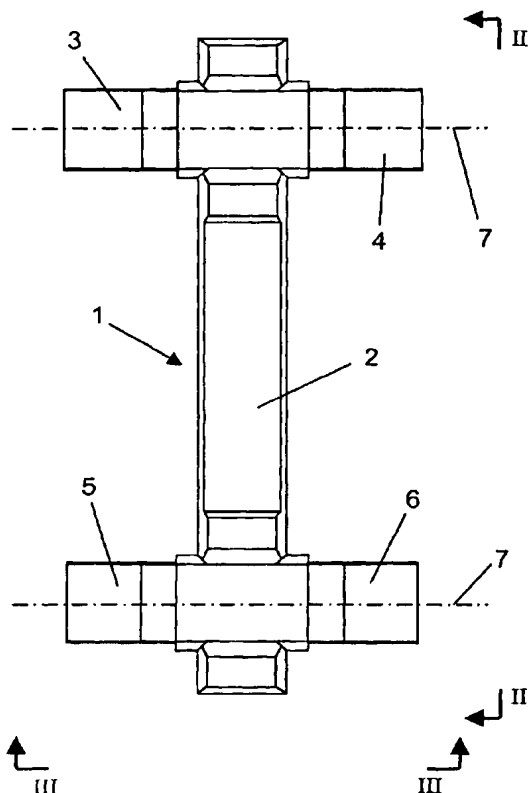
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- (71) Applicants (*for all designated States except US*): **COMPOSITE DAMPING MATERIAL N.V. IN HET KORT "CDM"** [BE/BE]; Reutenbeek 9, B-3090 Overijse (BE). **NIGTEVECHT BEHEER B.V.** [NL/NL]; Vreelandseweg 10, NL-1393 PG Nigtevecht (NL).
- (72) Inventors; and
(75) Inventors/Applicants (*for US only*): **CARELS, Patrick** [BE/BE]; Varensiaan 15, B-3090 Overijse (BE). **TASSERON, Johannes, Bastiaan** [NL/BE]; Fortsebaan 57, B-2930 Brasschaat (BE).
- (74) Agent: **CALLEWAERT, Koen**; Bureau Callewaert b.v.b.a, Brusselsesteenweg 108, B-3090 Overijse (BE).
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(54) Title: **SLEEPER AND RAILWAY BUILT BY MEANS OF THE LATTER**



(57) Abstract: The invention concerns a sleeper (1) comprising a cross beam (2) to mutually connect two rails (7) of a railway, situated next to one another and at a certain distance, whereby at least one arm (3, 4, 5, 6) is provided near at least one of the far ends of the cross beam (2), almost at right angles to the cross beam (2), which is designed as a longitudinal, preferably continuous support of a rail (16) extending in the longitudinal direction of said arm. The invention also concerns a railway provided with such a sleeper.

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SLEEPER AND RAILWAY BUILT BY MEANS OF THE LATTER

5 The invention concerns a sleeper, preferably made of concrete, which mainly consists of a cross beam to mutually connect two rails of a railway extending next to one another in the same direction.

 The invention mainly aims a sleeper which makes it possible, to a very large extent, to reduce the noise nuisance arising from coaches and the like, such as
10 trains or trams, riding on railways.

 According to the invention, a side arm is provided near at least one of the far ends of the cross beam, extending almost perpendicular to the longitudinal axis of this cross beam, and which is designed as a longitudinal support of a rail extending in the longitudinal direction of said arm.

15 Practically, two side arms are provided near the two far ends of the cross beam, situated opposite to one another, in line, and extending on either side of the cross beam, which are parallel to the base of said cross beam.

 According to a particular embodiment of the sleeper according to the invention, the above-mentioned arms near a specific free end of the cross beam are
20 shorter than the arms which are provided near the other far end of the cross beam.

 According to an advantageous embodiment of the sleeper according to the invention, coupling means are provided on the free ends of the side arms, which make it possible to connect two arms of two successive cross beams of a railway, situated opposite to one another and in line.

25 The invention also concerns a railway which has been built by means of sleepers as described above and/or as described in claims 1 to 13.

 Said railway is thus characterised in that its rails rest, in a continuous manner and over their entire length, on the side arms of the cross beams, whereby these arms extend under the rails in the longitudinal direction of the latter, in such a manner
30 that the free ends of the arms of two successive sleepers, directed towards one another,

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almost connect and, preferably, are coupled to one another by means of coupling means possibly known as such.

Other particularities and advantages of the invention will become clear from the following description of a few particular embodiments of the invention; this description is given as an example only and does not restrict the scope of the claimed
5 protection; the reference figures used hereafter refer to the accompanying drawings.

Figure 1 is a top view of a first embodiment of a sleeper according to the invention.

Figure 2 is a side view of this first embodiment.

10 Figure 3 is a front view of this embodiment.

Figure 4 schematically represents, to a smaller scale, a top view of a rectilinear part of a railway with sleepers according to the above-mentioned first embodiment.

15 Figure 5 schematically represents an analogous top view of an arched part of a railway with sleepers according to the above-mentioned first embodiment.

Figure 6 represents, to a larger scale, a top view with partial sections of two sleepers according to the above-mentioned first embodiment, coupled to one another by means of a sleeve.

20 Figure 7 represents, to a larger scale, a horizontal section of a part of two sleepers coupled to one another by means of a mortise and tenon joint.

Figure 8 represents, to a larger scale, a vertical section of a part of two sleepers coupled to one another by means of a mortise and tenon joint.

Figure 9 schematically represents a top view of two sleepers situated next to one another which are coupled to one another by means of protrusions.

25 Figure 10 is a cross section according to line X-X from figure 9.

Figure 11 is a cross section of a cross beam as well as of an arm of a sleeper according to a specific embodiment of the invention.

Figure 12 is a vertical section according to the longitudinal axis of the rails, of a part of a railway according to the invention.

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Figure 13 is a vertical section according to line XIII-XIII in figure 12 of the rails of a part of a railway according to the invention.

Figure 14 schematically represents a top view of a sleeper according to the second embodiment of the invention.

5 In the different figures, the same reference figures refer to identical or analogous elements.

The invention in the first place concerns a sleeper 1 made of concrete which consists of a cross beam 2 to mutually connect rails situated next to one another and at a certain distance. Said sleeper 1 has at least one and, as represented in figures 1
10 to 3, preferably four side arms 3, 4, 5 and 6 which extend at right angles to the cross beam 2 and which are designed as a longitudinal, preferably continuous support of the rails. These rails which are known as such are schematically represented in figure 1 by an axis 7.

Said arms 3, 4, 5 and 6 are provided in pairs near each of the two far ends
15 of the cross beam 2, and they extend on either side, crosswise to the latter.

The arm 3 extends in line with the arm 4, near one of the far ends of the cross beam 2, and it has the same length as the arm 4, whereas the arms 5 and 6, which extend in line near the other far end of the cross beams 2 and 4, also have the same length.

20 In particular, the arms 3 and 4 are somewhat longer, for example 1 to 6%, than the arms 5 and 6.

This has for a major advantage that straight as well as bent parts of a railway can be formed with the same sleepers.

In an advantageous manner, the far ends of the arms 3, 4, 5 and 6 are
25 bevelled to this end, and thus each have an end face. The end faces of the arms 3 and 5, 4 and 6 respectively, which are provided on one and the same side of the cross beam 2, are situated in a single plane which extends almost crosswise to the top face of the sleeper and which forms an angle with the longitudinal axis of the cross beam 2 which is not 90°. Preferably, the angle between these end faces and the longitudinal axis of
30 the sleeper 2 is between 1° and 5°, preferably almost 1.5°.

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As is represented in figure 4, all one has to do is each time make a sleeper in a railway connect to a following sleeper, turned at an angle of 180° around a vertical central axis in relation to the adjacent sleeper, to form a straight part of a railway. In this manner, a long arm 3 or 4 is always connected to a short arm 5 or 6.

5 If, as represented in figure 5, a bent part of a railway has to be formed, all one has to do is put the longer arms 3 and 4 of two successive sleepers in line, such that also the shorter arms 5 and 6 end up in line.

In order to form such an arched part with a specific radius of curvature, all one usually has to do is place the free ends of the shortest arms 5 and 6 and/or long
10 arms 3 and 4, which are directed towards one another, at a certain distance from one another.

A specific radius of curvature for an arched part of the railway is obtained by placing a specific number of sleepers with their shortest and longest arms in line next to one another, possibly alternating with a sleeper which is turned over 180°
15 around a vertical axis.

On the free ends of the arms are preferably provided coupling means which make it possible to mutually connect two arms situated opposite to one another and in line.

Such coupling means make sure that transverse forces arising in a certain
20 sleeper are divided over the adjacent sleepers. Such transverse forces arise for example when a train rides over the railway. As the transverse forces are divided over different sleepers, the rails 7 will bend only slightly or not at all under the load of a train.

This makes sure that vibrations which may nevertheless arise due to a possible bending of the rails, are almost immediately damped, which has for a result
25 that significantly less noise is produced and that the rails are moreover less liable to wear than in the case of a conventional railway.

Moreover, the coupling element is made such that it is possible to build bent railways with varying radiuses of curvature with one and the same type of sleeper.

Figure 6 represents a first embodiment of such a coupling element which
30 consists of a sleeve 8 which is slid on two free ends of arms 3, 4, 5 and 6 situated in line

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and directed towards one another, whereby also the free ends are directed towards one another.

In order to be able to realise this in a simple manner and to allow for a certain play or rotation between two sleepers which are to be connected in this manner, the far ends concerned are somewhat tapered, as is illustrated in figure 6. This is particularly important when an arched part of a railway has to be built.

Figures 7 and 8 represent another embodiment of a coupling means.

This coupling means consists of a mortise and tenon joint, whereby the free ends of the arms which are situated on one side of the cross beam 2 are provided with a pin or dowel 9, and the free ends of the arms on the other side of the cross beam are provided with a corresponding opening 10, which consists for example of a recess. Also in this embodiment, one has to make sure that the two arms connected to one another can slightly rotate.

A particularly interesting embodiment of the cross beam 2 is represented in figures 9 and 10. In this embodiment, the coupling means is formed of protrusions 20 which are provided near the far end of the above-mentioned arms 3, 4, 5 and 6 and which extend almost crosswise to the latter. In particular, the protrusions 20 are situated on the standing lateral surfaces of the arms 3, 4, 5 and 6.

These protrusions 20 consist of metal rods which extend through the arms 3, 4, 5 and 6 and which are thus anchored in the sleeper 1. In an advantageous manner, these protrusions 20 are part of a reinforcement provided in the sleepers 1, which is not represented in the figures.

Further, the sleeper according to the invention can be provided with at least one adjusting means 13. Such an adjusting means 13 makes it possible to set the height of cross beams 2 connecting to one another in a railway, such that the rails can be laid almost entirely flat.

Thus, the adjusting means 13 comprises a bolt 21 which can be moved according to the longitudinal direction thereof and which extends almost vertically to underneath the lower surface 22 of the corresponding sleeper 1.

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Said bolt 21 works in conjunction with a vertical recess 26 provided to this end, provided near one far end 23 of the cross beam 2. This recess extends from the upper surface 24 of the sleeper 1 up to the lower surface 22 thereof, such that, in order to adjust the height of a sleeper 1, all one has to do is turn the bolt 21 extending in the recess via the upper surface 24, such that it is moved in a vertical direction in relation to the sleeper 1.

The cross beam 2 and the arms 3, 4, 5 and 6 represent a cross section in the shape of a trapezium, whose largest side may be situated both at the top or at the bottom.

If the largest side of the trapezium is situated at the bottom, a longitudinal, collar-shaped edge 11 will preferably be provided on the lower side of the cross beam 2 and of the arms 3, 4, 5 and 6, for example as is represented in the accompanying figure 11.

In order to build a railway by means of the sleeper described above and represented in the figures, one generally proceeds as is schematically illustrated in figure 12.

Sleepers 1 are placed next to one another, whereby, as described above, the far ends of the arms 3, 4, 5 and 6 of successive sleepers 1 connect to one another. The sleepers 1 hereby lean via the above-mentioned adjusting means, in particular via the lower end of the bolt 21, on an adjusting tile 14 which rests on the bottom 12 upon which the railway is built.

Said adjusting tile 14 preferably consists of a concrete slab and makes sure that the load, resulting from the weight of the sleeper 1, is sufficiently divided to prevent the bolt 21 from penetrating in the bottom 12.

In certain cases it may be necessary to make a continuous bearing surface in the shape of a concrete bedding. In this case it is not necessary to use the above-mentioned adjusting tiles 14.

As the sleepers 1 lying next to one another are mutually connected via coupling means between the connecting arms 3, 4, 5 and 6, it is possible to adjust the height of the sleeper 1 without reversing it.

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When the railway contains sleepers 1 with a coupling means, as is represented in figures 9 and 10, the protrusions 20 of two connecting arms 3, 4, 5 and 6 are connected to one another by means of at least one relatively rigid connecting element 25.

5 This connecting element 25 preferably consists of one or several metal rods which are welded onto the protrusion 20, situated on one and the same side of the respective arms 3, 4, 5 and 6. Thus is formed a relatively rigid connection between two connecting arms of two sleepers lying next to one another.

 After the sleepers 1, which are part of the railway, have been connected
10 to one another via the respective coupling means, and after the height of the different sleepers has been adjusted with the above-mentioned adjusting means 13, the sleepers 1 are cast in concrete, at the most up to the height of their upper surface 24, as indicated by means of reference figure 15 in figure 12. Consequently, the space between and under the sleepers 1 is thus filled with concrete, whereby the coupling means are also
15 surrounded by concrete.

 When the coupling means consist of the above-mentioned protrusions 20, which are connected to a connecting element 25, a reinforced-concrete connection is thus formed between two successive sleepers 1.

 The next step consists in fixing the rails 16 according to the axis 7 of the
20 arms 3, 4, 5 and 6 on the cross beams 2 by means of fastening means known as such and which are not represented in the accompanying drawings, such as "Vossloh" fasteners, which consist of a spring terminal which is pressed onto the side edge of the foot of the rail by means of a bolt. The rails 16 hereby rest over their entire length on the aforesaid arms 3, 4, 5 and 6 of the sleepers 1 lying next to one another.

25 In order to compensate for possible unevennesses in the upper surface 24 of the sleepers and in order to obtain an additional noise deadening and vibration isolation, an elastic strip can be provided between the rails 16 and the arms 3, 4, 5 and 6, which is not represented in the accompanying drawings.

 In a second embodiment of the sleeper according to the invention, as is
30 schematically represented in figure 14, the cross beam 2 consists of two concrete blocks

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17 and 18 which are mutually connected to one another by means of a metal strut 19 whose far ends are anchored in these blocks 17 and 18 and whose axis is situated in the plane of symmetry of the latter.

This strut 19 has for example an L- or I-shaped cross section.

5 In yet another embodiment of the sleeper according to the invention, the cross beam extends over the entire length of the arms, such that the short arms of the sleeper are transferred in a continuous manner in the long arms thereof, via said cross beam.

10 The invention is by no means restricted to the above-described embodiments represented in the accompanying drawings; on the contrary, several variants are possible, both as far as the dimensions and shapes of the sleepers are concerned as well as the railways built by means of the latter.

15 Thus, the sleeper according to the invention may consist of a cross beam with one or two arms on one of its longitudinal sides, or also of a cross beam with only two arms extending on either side on one of the far ends 23 of the cross beam. Possibly, the free ends of the arms 3, 4, 5 and 6 may be slightly bevelled, such that two arms situated in line can be better connected to one another.

CLAIMS

1. Sleeper (1) with a cross beam (2) to mutually connect two rails
5 (7) of a railway situated next to one another and at a certain distance, whereby at least
an arm (3,4,5,6) is provided near the far ends of the cross beam (2), almost at right
angles to the cross beam (2), which is designed as a longitudinal, preferably continuous
support of a rail (16) extending in the longitudinal direction of said arm, **characterised**
in that the arm (5,6), which is provided near a first far end of the cross beam (2), is
10 shorter than the arm (3,4) which is provided on the other far end of this cross beam (2).

2. Sleeper according to claim 1, characterised in that, near the two
far ends of the cross beam (2), along both sides of said cross beam (2), two arms
(3,4,5,6) are provided, extending opposite to one another and situated in line.

3. Sleeper according to claim 2, characterised in that the arms
15 (3,4,5,6) near one and the same far end of the cross beam (2) have almost the same
length, as a result of which the longitudinal axis of the cross beam is situated in a plane
of symmetry.

4. Sleeper according to any of claims 1 to 3, characterised in that,
near a specific far end of the cross beam (2), the arms (5,6) are almost 1 to 6% shorter
20 than those near the other far end of the cross beam (2).

5. Sleeper according to any of claims 1 to 5, characterised in that far
ends of the arms (3,4,5,6) are bevelled and thus each represent an end face, whereby the
end faces of the arms (3 & 5, 4 & 6) which are provided on one and the same side of the
cross beam (2) are situated in a single plane, which extends almost crosswise to the top
25 face of the sleeper (2) and forms an angle with the longitudinal axis of said cross beam
(2) which is not 90°.

6. Sleeper according to any of claims 1 to 5, characterised in that on
the free ends of the arms (3,4,5,6) are provided coupling means which make it possible
to connect two arms (3,4,5,6) of two successive cross beams (2) of a railway, placed
30 opposite to one another and in line.

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7. Sleeper according to claim 6, characterised in that said coupling means consist of protrusions (20) which are provided on the above-mentioned arms (3,4,5,6) and which extend almost crosswise to the latter.

8. Sleeper according to claim 7, characterised in that said
5 protrusions (20) consist of metal rods extending partially in the above-mentioned arms (3,4,5,6) and which are thus anchored in them.

9. Sleeper according to any of claims 1 to 8, characterised in that the cross beam (2) has a cross section in the shape of an isosceles trapezium, whereby the largest base is situated at the bottom and whereby a longitudinal, collar-shaped edge
10 (11) is provided on the two longitudinal sides of said largest base.

10. Sleeper according to any of claims 1 to 9, characterised in that, on at least one of its far ends, it is provided with an adjusting means (13) to set the height of the sleeper (1).

11. Sleeper according to claim 10, characterised in that said adjusting
15 means (13) comprises a bolt (21) which can be moved according to the longitudinal direction of the latter and which mainly extends according to a vertical direction to at least underneath the lower surface (22) of the sleeper (1).

12. Sleeper according to claim 10 or 11, characterised in that said adjusting means (13) co-operates with a recess (26) provided to this end in said far end
20 of the sleeper (1).

13. Railway, characterised in that it comprises successive sleepers (1) according to any of claims 1 to 12, whose arms (3,4,5,6), near the corresponding far ends (23) of the cross beams (2), are situated in line and extend with their free ends almost connected, so as to form an almost continuous support for a rail (16), resting on
25 said arms (3,4,5,6) in the longitudinal direction.

14. Railway according to claim 13, characterised in that the sleepers (1) are at least partially cast in concrete (15).

15. Railway according to claim 14, characterised in that, when it comprises said sleepers (1) according to any of claims 6 to 8, said coupling means are
30 connected to one another via a connecting element (25).

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16. Railway according to claim 15, characterised in that said connecting element (25) is formed of at least a metal rod, in particular of a concrete reinforcement.

17. Railway according to any of claims 13 to 16, characterised in
5 that, when it contains sleepers according to any of claims 11 to 13, said adjusting means (12) rests on the bottom (12) under the railway, either or not via an adjusting tile (14).

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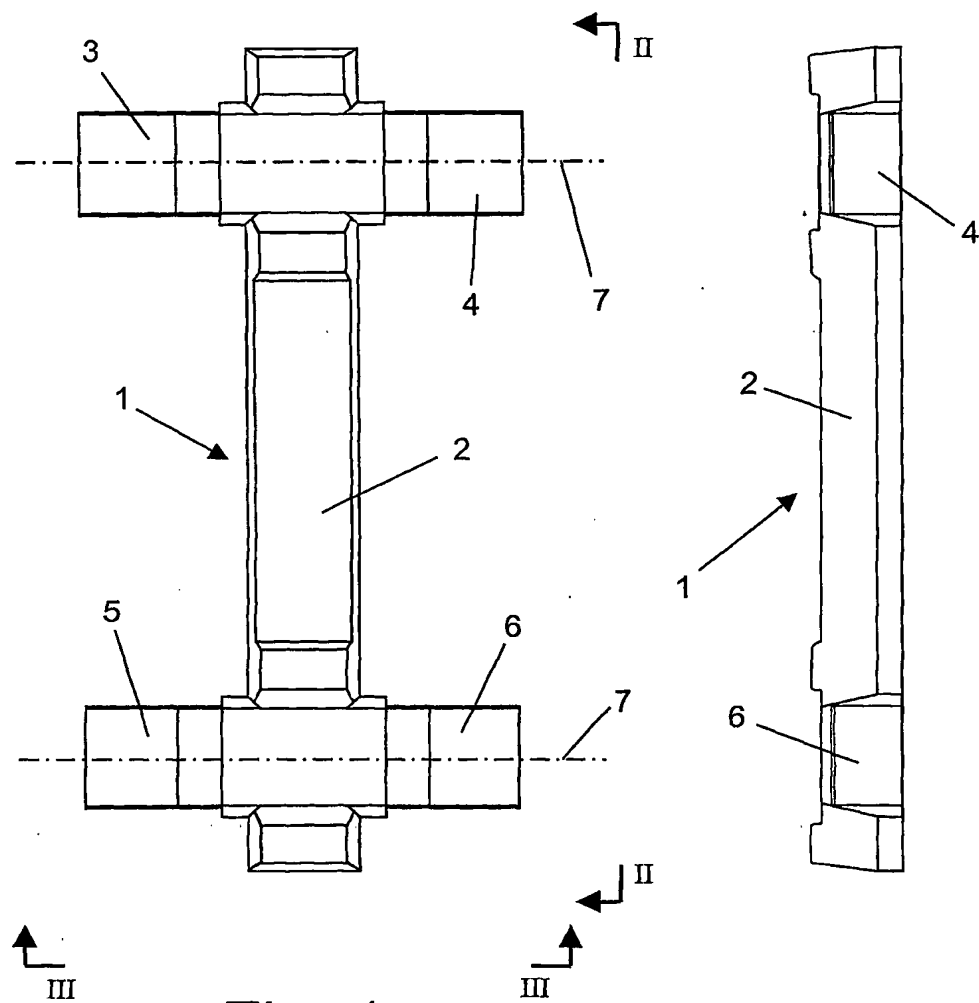


Fig. 1

Fig. 2

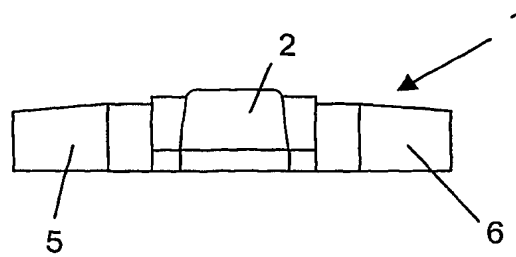


Fig. 3

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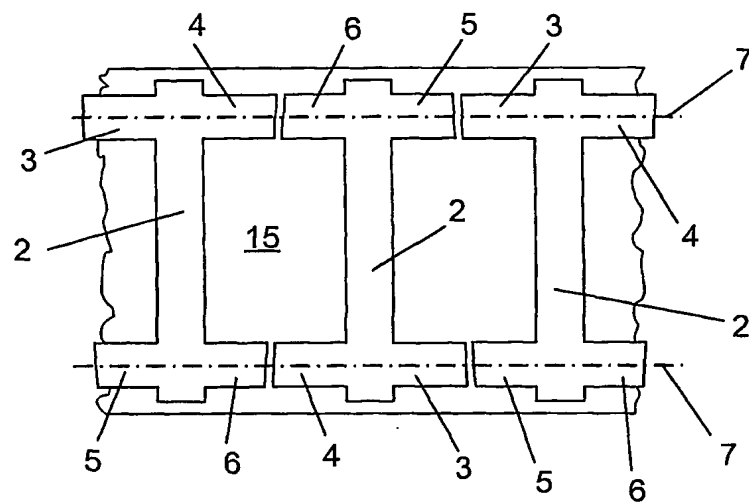


Fig. 4

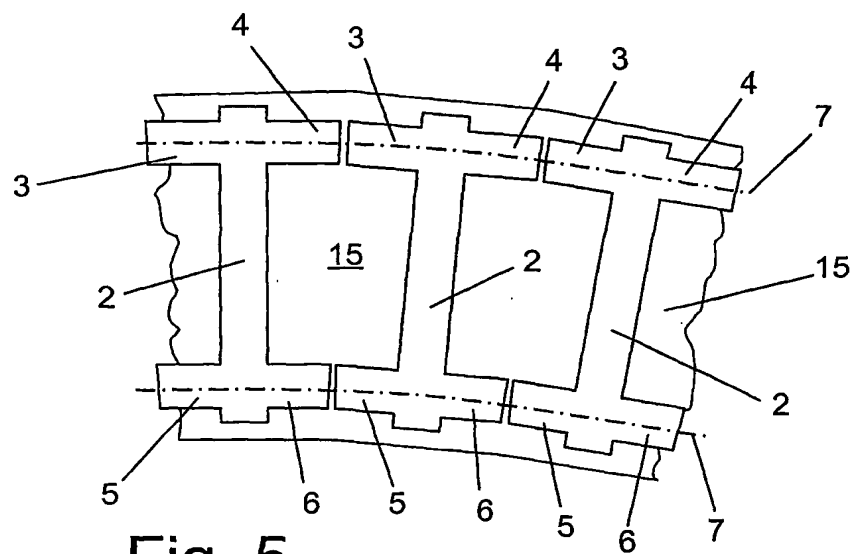


Fig. 5

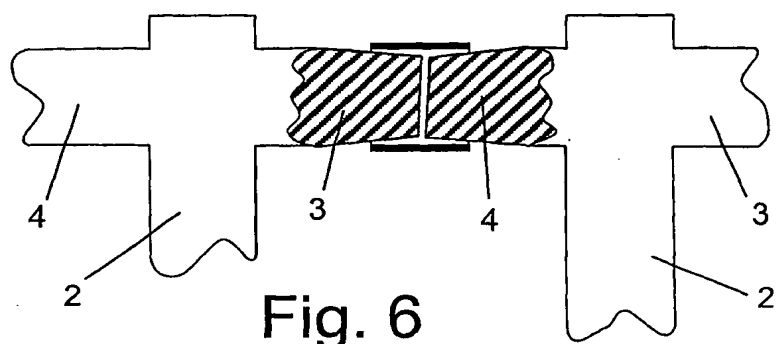


Fig. 6

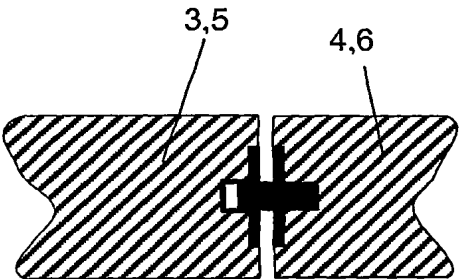


Fig. 7

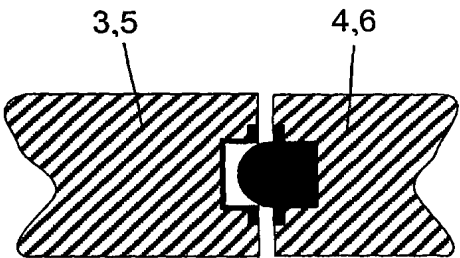


Fig. 8

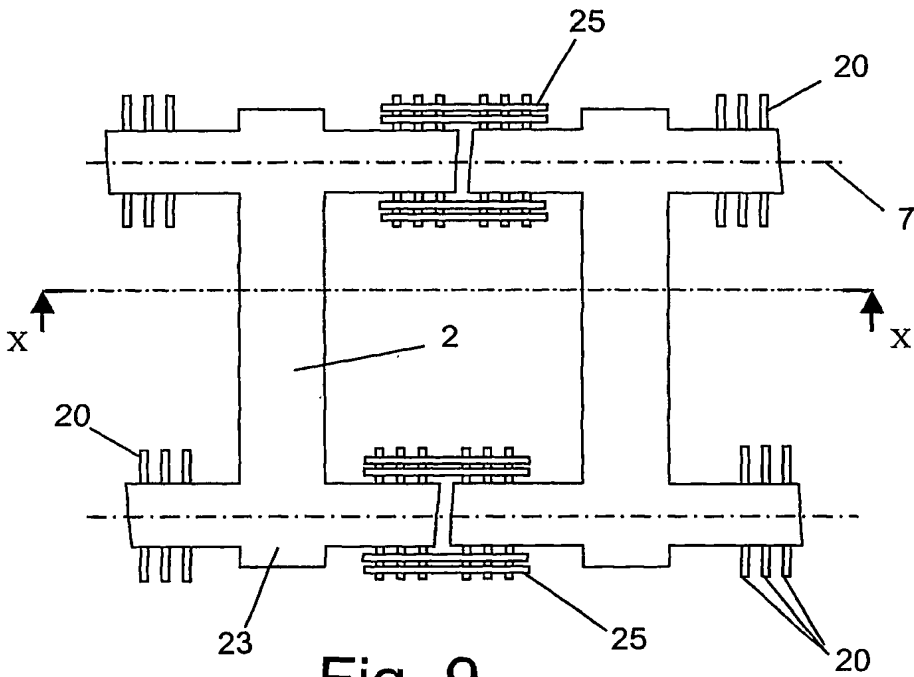


Fig. 9

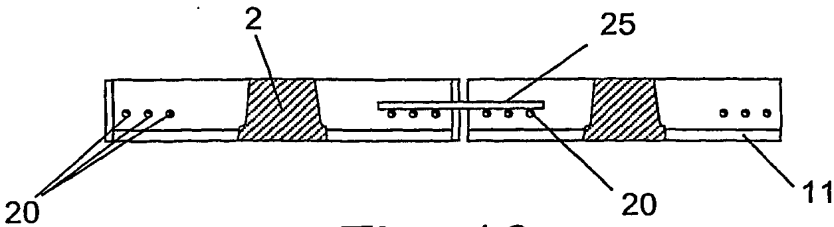


Fig. 10

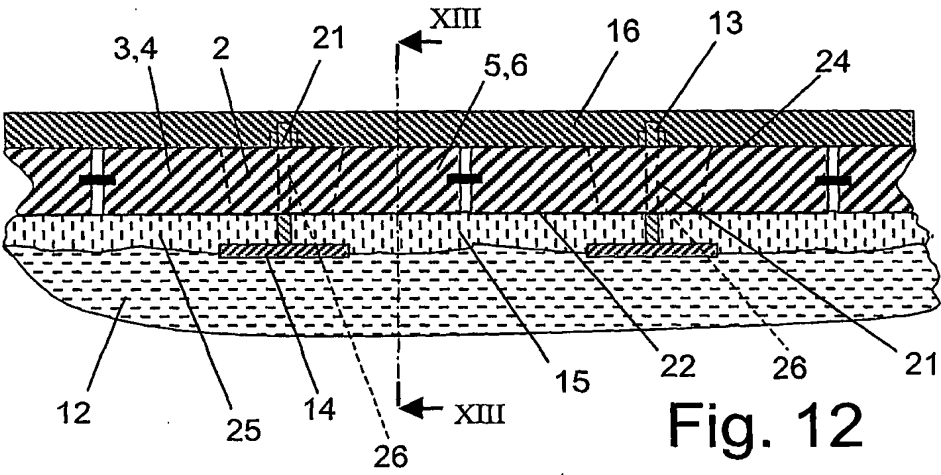


Fig. 12

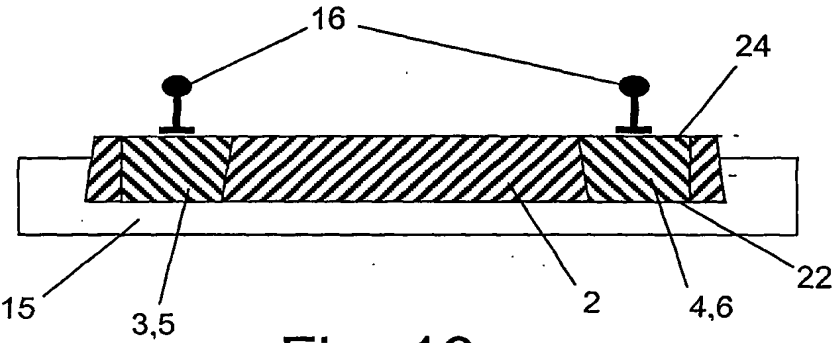


Fig. 13

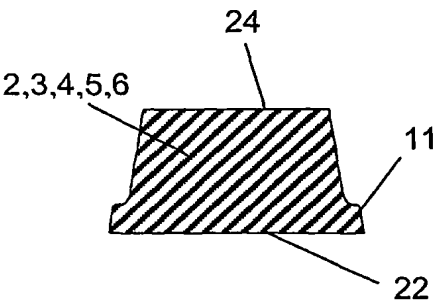


Fig. 11

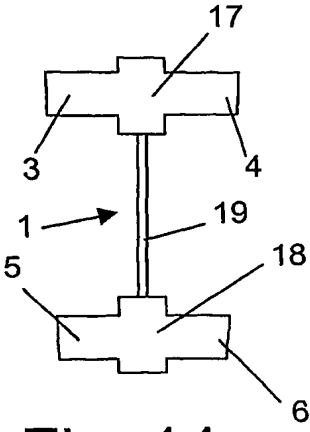


Fig. 14

INTERNATIONAL SEARCH REPORT

International Application No

PCT/BE 01/00067

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E01B3/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 09 273102 A (RAILWAY TECHNICAL RES INST) 21 October 1997 (1997-10-21)	1-3,5
A	figures 3,4,8,9	4
A	DE 51 042 C (AMOS KINZER HOFFMEIER)	1,6,13,15,16
	page 1, right-hand column, line 20-29; figure 2	
A	US 3 762 641 A (SCHUBERT) 2 October 1973 (1973-10-02)	1,6-9,13-16
	figures 3,9	
A	NL 95 429 C (NEDERLANDSCHE SPOORWEGEN)	
A	US 1 387 872 A (STOCKWELL) 16 August 1921 (1921-08-16)	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

26 July 2001

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Name and mailing address of the ISA

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NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 09273102 A	21-10-1997	NONE	
DE 51042 C		NONE	
US 3762641 A	02-10-1973	CA 948168 A CH 545376 A DE 2155479 A FR 2121204 A GB 1373520 A IT 943703 B ZA 7200068 A	28-05-1974 15-12-1973 20-07-1972 18-08-1972 13-11-1974 10-04-1973 27-12-1972
NL 95429 C		NONE	
US 1387872 A	16-08-1921	NONE	